Research Paper

Estimation of Aggregate Consumption Function of Healthcare Services in Iran in 1981-2011

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Abstract

Consumption of health services is an important variable which is correlated with the national health accounts and/or the variables representing total income spent on health services and households' ability to pay. Studies on consumption function of health services also provide evidence concerning elasticities and marginal propensity to consume health services. This study in descriptive-analytical context aims to estimate households' consumption function of health services, using data from the Iranian national health accounts and households' income-expenditure annual surveys during the period of 1981-2011. The study concentrates on the estimation of consumption elasticities and marginal propensity to consume in the Iranian health sector, along with the different characteristics of the estimation results in the short-run and long-run, using error-correction model and E-views8 econometric software.

The result showed that, regarding the error-correction coefficient in the short-run, 37 percent of any disequilibrium between actual and equilibrium values of consumption of health services is made up in the long-run. This coefficient also implies that any short-run reduction in the national health expenditure takes 3 years to be compensated. In addition, the marginal propensity to consume health services in the study period equals 0.88, and the elasticities of the consumption with respect to income spent on health services and households' liquid assets in the short-run are 0.76 and 0.16, respectively, and in the long-run are 0.90 and 0.26, respectively. These imply that any unexpected reduction in the government spending on healthcare services, induced by reduction in the government revenues, results in decline of the total health expenditure, and then, sharp decline of households' consumption of health services. .

Keywords: National Health Accounts, Households' Liquid Assets, Marginal Propensity to Consume, Error Correction Model

Introduction

Health economics concentrates on the topics that mostly provide advices to health authorities and private agents to understand optimum use of human and capital resources for production and supply of healthcare services. Advances in knowledge and medical technology and in methods of health services provision, changes in lifestyle and social and cultural structure, changes in diseases patterns and medical needs of people, health promotion and more attention paid to health by policy makers and planners, as well as increased awareness and rapid growth of population have totally made people to spend a great part of their income on health, to demand for health services more than the available supply of them, and to witness obstacles for increasing health services provision (Deb and Trivedi, 2002; Feldstein, 2011; Sabagh Kermani and Shaghaghi, 2004). Regarding a high level of consumption in the advanced economies, the developed countries have usually dedicated a larger share of GDP to the health sector than the developing countries. In Iran, the share of health services expenditure in GDP increased from 3.8 percent in 1995 to 6.7 percent in 2013, which represents a considerable growth in the recent years (WHO, 2016). In economics, general studies on consumption

examine the characteristics of consumption behavior in response to changes in certain or expected variables, and quantify the effects of variables by elasticities and marginal propensity to consume.

The main objective of the consumption analysis in the health sector is studying and identifying the factors that have considerable effects on households' health. Understanding the causal relationship in the consumption function helps policy planners and makers to identify the mechanism of changes in the households' consumption of health services, and to assess the impact of policy variables on consumption of health services. As a result, it could be possible to create scenarios for health services consumption with regard to different trends and factors, and, if necessary, to control changes and produce adjustments in the consumption of health services. The scenarios should be considered suitable and consistent with favorite policies and decisions that pursue the required changes through modifying effective variables in the health sector (Naghavai and Jamshidi, 2006). Consumption is the variable that changes in response to variations in national income and wealth in the economy. The key relationship between consumption and income was theoretically explained by Keynes and his followers. Since in many countries close to half of the national expenditure is determined by households' consumption, understanding the structure of this component of aggregate expenditure could be viewed as the support for identifying the short-run and long-run changes in the overall economy. This implies that recognition of the determinants of households' consumption and the effects of changes in some macroeconomic variables on consumption are considered to be essential, and that this provides the tools and criteria needed for explaining consumption behavior or the adjustments induced by policy makers (Altunc and Aydin, 2014; Mei, 2012).

In general, consumption is not only important for economic studies, but it is also highly important in modeling schools of thoughts, cultural conditions, and optimal behavior in human life in the society. One of the most important issues that draws attention to aggregate consumption is the relationship between it and behavior of the households classified in different income groups. Hence, accurate understanding of the consumption function and estimation of the marginal propensity to consume help policy makers to adopt right policy tools to cope with the economic questions (Rajaii and Sh, 2012). The present study aimed at estimating the total Iranian consumption function for healthcare services, with the data from the Iranian national health accounts and households' income-expenditure annual surveys during 1981-2011.

Method

This research is a statistical-analytical study on households' consumption of health services in Iran. To analyze the data, we used Error-Correction Model (ECM) and E-views8 analysis software. The aggregate households' consumption of health services was defined as a function of aggregate income spent in the health sector of the Iranian economy, equal to national health expenditure, and of aggregate households' liquid assets. That is,

$$C_H = C_0 + c * Y_H + b * W_H \quad (1)$$

where, C_0 represents the initial aggregate households' consumption of health services, Y_H is the national income spent on health services (national health expenditure, NHE), W_H is the aggregate households' liquid assets, and c and b are the coefficients representing marginal propensities to consume from income and aggregate assets, respectively.

Aggregate households' liquid assets is measured by households liquid savings that otherwise could be spent on education and recreational services. The data were extracted from the Iranian annual NHE accounts, annual households' income-expenditure surveys and national accounts from the Iranian Statistical Center and the Central Bank of Iran during the period of 1981 - 2011. Equation (1), as the households' consumption function of healthcare services was considered in logarithmic form within the error-correction regression framework in the following relation.

$$\begin{aligned}\Delta \ln C_{H,t} = & \alpha_1 * \Delta \ln Y_{H,t} + \alpha_2 * \Delta \ln W_{H,t} \\ & + \alpha_3 * (\ln C_{H,t-1} - \alpha_4 - \alpha_5 * \ln Y_{H,t-1} - \alpha_6 * \ln W_{H,t-1}) \\ & + \alpha_7 * Dum_1 + \alpha_8 * Dum_2\end{aligned}\quad (2)$$

Where, $\ln$ denotes Neperian logarithm and Δ shows annual changes in the selected period. Also the relation within the brackets represents the lagged value of error term in the model. The dummy variables of Dum_1 and Dum_2 represent unexpected sharp changes in consumption arising from the years in war, 1985-1989, and highly increased consumption during 2009-2011 arising from unusual subsidy payments by the government. Dummy variables take value 1 in the denoted years, and value zero, otherwise.

The estimation of logarithm equation (2) resulted in values for coefficients α_4 and α_5 that are the long-run values of elasticities of health services consumption with respect to aggregate income spent on health services and households' liquid assets, respectively. That is,

$$\frac{\Delta C_H}{\Delta Y_H} \cdot \frac{Y_H}{C_H} = \alpha_4 \quad (3-1)$$

$$\frac{\Delta C_H}{\Delta W_H} \cdot \frac{W_H}{C_H} = \alpha_5 \quad (3-2)$$

To determine the marginal propensity to consume ($\frac{\Delta C_H}{\Delta Y_H}$ during 1981-2011 based on Equation (3-1), we multiply the estimated coefficient of α_4 by average consumption, $\frac{C_H}{Y_H}$. The result is shown by

$$\frac{\Delta C_H}{\Delta Y_H} = c \quad (4)$$

According to Equation (4), the marginal propensity to save, s , during 1981-2011, could be shown by,

$$s = 1 - c \quad (5)$$

Figure 1 shows the long-run trend in the variables during 1981 - 2011. In estimating the time-series regression models, it is required to avoid spurious regression results by testing for unit roots for the variables. In this

Fig. 1 Long-run Trends in the National Health Expenditure, Household Liquid Assets, and Household Health Services Consumption

study, the Dickey-Fuller unit root test was applied to prove that all the variables are integrated of the same Order 1. The results are shown as in Table 1.

Table 1 Unit Root Test Results

Form	Variable name	Statistics	Significance level	Result
Level	$LnW_{H,t}$	0.6169	0.9873	I(1)
	$LnC_{H,t}$	2.3	0.9999	I(1)
	$LnY_{H,t}$	-0.6241	0.8506	I(1)
Differencing	$\Delta LnW_{H,t}$	-10.84	0.000	I(0)
	$\Delta LnC_{H,t}$	-4.281	0.0023	I(0)
	$\Delta LnY_{H,t}$	-5.73	0.0001	I(0)

The Dickey-Fuller test results showed that all the variables are nonstationary in level values, but they are stationary after first differencing, i.e. they are integrated of Order 1, at significance level of less than 1%.

Since the purpose of this study is estimating the consumption function of health services, in the model with differencing variables, $\Delta LnC_{H,t}$, $\Delta LnY_{H,t}$, and $\Delta LnW_{H,t}$ to capture the long-run relationship between the consumption variable, $LnC_{H,t}$, and the explaining variables, $LnY_{H,t}$ and $LnW_{H,t}$, we use the error-correction model (Gujarati, 2008). The standard error-correction model in general form could be presented by,

$$\Delta Z_t = \beta_1 \Delta X_t + \beta_2 (Z_{t-1} - \gamma X_{t-1}) + u_t \quad (6)$$

In Equation (6), ΔZ_t and ΔX_t are characterized by the integrating order shown by $I(0)$. In this equation, the bracket terms are error-correction terms. Provided that Z_t and X_t are co-integrated with factor γ ,

hence, $(Z_{t-1} - \gamma X_{t-1})$ has order zero, characterized by $I(0)$. This implies that the OLS method is valid and statistical inferences are possible, and that the model is a viable model and there is no concern about spurious regression problem. Using the implied characteristics of the error-correction model for consumption function of health services in Iran, this study will review the estimated result of this function in the years 1981-2011.

Results

The results of regression estimation of equation (2) are presented in Table 2.

Table 2 The results of the regression estimation of equation (2)

$\Delta \ln C_H = \alpha_1 \Delta \ln Y_H + \alpha_2 \Delta \ln W_H + \alpha_3 (\ln C_{H,t-1} - \alpha_4 - \alpha_5 \ln Y_{H,t-1} - \alpha_6 \ln W_{H,t-1}) + \alpha_7 Dum_1 + \alpha_8 Dum_2$		
coefficient	variables	p-value
$\Delta \ln Y_H$	$\alpha_1 = 0.764$	0.00***
$\Delta \ln W_H$	$\alpha_2 = 0.158$	0.086*
	$\alpha_3 = -0.369$	0.026**
$\ln C_{H,t-1}$	1	
	$\alpha_4 = -2.547$	0.398
$\ln Y_{H,t-1}$	$\alpha_5 = 0.897$	0.081*
$\ln W_{H,t-10.151}$	$\alpha_6 = 0.260$	0.151
Dum_1	$\alpha_7 = 0.077$	0.053*
Dum_2	$\alpha_8 = 0.279$	0.004**

* Significant at the 10 percent level.

** Significant at the 5 percent level.

*** Significant at the 1 percent level.

The results of regression estimation of equation (2) are presented in Table (2). The R-squared value of 0.82 ($R - squared = 0.82$) means that 82 percent of the variation in dependent variable is explained by independent variables, a fairly high value considering that the maximum value of R-Squared can at most be 1. The estimated Durbin-Watson statistic with the value of 1.98 ($Durbin - Watson = 1.98$) confirms lack of autocorrelation of the first order at 1% significance level. The Durbin-Watson statistic is a test for first-order serial correlation. More formally, the DW statistic measures the linear association between adjacent residuals from a regression model. If there is no serial correlation, the DW statistic will be around 2. We also for more investigation applied the Breusch-Godfrey test of autocorrelation. The null hypothesis of the LM test is that there is no serial correlation up to lag order ρ . The LM test with two lags were used that results from test demonstrated the lack of correlation between the residuals of the fitted regression line. LM (1) and LM (2)

statistics, respectively 0.000 and 0.032 with the p-values (0.978) and (0.984), compared by the critical values in table (χ^2) at significance level of 5% and degrees of freedom 1 and 2, confirms lack of autocorrelation problems of orders 1 and 2. White nR2 statistic with the value of 6.713 ($White\ nR_2 = 6.713$) and p-value 0.459, compared with the critical value in table (χ^2) at significance level of 5% confirms the null hypothesis of the absence of heteroscedasticity.

According to the results in Table 2, coefficient α_3 , equaling to -0.369, represents the error-correction coefficient in the model and suggests that with this rate for consumption adjustments in the short-run, it can be correlated with the consumption in the long-run. Also, α_5 as the slope of the long-run consumption function with respect to aggregate income spent on health services could be used to estimate the marginal propensity to consume by the relation expressed in Equation (3-1). This could be shown by the following outcome: $\frac{\Delta C_H}{\Delta Y_H} \cdot \frac{Y_H}{C_H} = 0.897$, $\frac{C_H}{Y_H} = 1.019$, $\frac{\Delta C_H}{\Delta Y_H} = 0.8795$ during 1981-2011.

The estimated value of the marginal propensity to consume health services in the Iranian healthcare sector equals 0.88. Using Equation (5), the marginal propensity to save in the same period is $s = 0.1205$ during 1981-2011.

Discussion

The results in Table 2 shows that error-correction coefficient α_3 equals -369. This implies that 37 percent of any disequilibrium between actual and equilibrium values of households' consumption of health services in the short-run is made up in the long-run trend. In other words any shock or imbalance would not be corrected quickly, and about 37 percent of deviation in the short-run disappeared and would be compensated in the long-run, and the effectiveness of policy in the short-run would be reduced at 37 percent. The results also show that the elasticities of households' consumption of health services with respect to aggregate income spent on health services in the short-run and long-run are 0.764 and 0.897. These indicate that for 10 percent increase in income spent on health services in the short-run and long-run, households' consumption of health services increases by 7.64 percent and 8.97 percent, respectively. This finding points out that the stability of aggregate income spent on health services, when the Iranian economy suffers from unexpected income reduction in the years under sanctions, is important to hold households' consumption of health services at steady state. Also, regarding the 37 percent for short-run correction rate, any shock of short-run reduction in aggregate income takes 3 years to be compensated in the long-run. In fact, in the Iranian health sector, any reduction in government budget, and, hence, government spending on healthcare services, e.g. the reduction induced by recessions or sanctions, have been normally compensated by allocating more households' income to health expenditure. This is a significant nature of the Iranian national health accounts in the last 30 years (Kazemian, 2011).

Additionally, the estimation results show that the elasticities of households' consumption of health services with respect to households' liquid assets in the short-run and long-run are 0.16 and 0.26, respectively. That is, for 10 percent increase in households' liquid assets, households' consumption of health services rises at 1.6 percent and 2.6 percent rates in the short-run and long-run, respectively. Since in times of high inflation and

economic recession along with high unemployment rate, households are in the shortage of liquid assets, and spend more share of their assets on essential needs, they lack enough support for accepting health services expenditure in such hard times. The results from short-run and long-run elasticities indicate that in such times, 16 to 26 percent of households' share in health services expenditure could not be supported easily. This implies that in the years of recession and/or sanctions, lack of enough supports from government for health services expenditure, and low level of households' ability to pay, when they are in the shortage of liquid assets, may push households towards catastrophic health care costs (Abolhallaje, Hassani, Bastani, Ramezani, & Kazemian, 2013).

It was stated in the World Health Report (WHO, 2000) that one of the goals of health systems is supporting households against financial risks of health costs. This suggests that, for example, in the Iranian economy the government role of holding aggregate health expenditure at stable state in the long-run is highly important. This is because any reduction in the government share of accounts in the national health expenditure raises the share of households in health expenditure which would otherwise make households at financial risks to pay for the increased share of them for healthcare costs. In such a situation, the Iranian households need to find another kind of supports from the social health insurance system to protect themselves. But, access to the social health insurance system in Iran is limited. Only people working in the formal sector of the economy may experience such a health insurance mechanism. Before 2014, the remaining groups of people, who work in self-employed and informal sectors, were subject to an arbitrary health insurance mechanism. In 2014, the government provided free insurance services for these groups, mostly inpatient service. But, still shortages of funds for these groups from their own pocket for outpatient services, and lack of enough government funds for holding free inpatient services hold many people at financial risks of health costs. This study has provided estimation of consumption function at sector level, regarding health sector performance and health services expenditure in the short-run policy rules and the long-run trend of health and social welfare development in Iran (Mahboobi, Meskarpour, and Pakdaman, 2013). This study aimed to support policy makers to find out the relationship between consumption of health services and their supporting funds, and the impact of changes in funds on the use of health services in the short-run and long-run.

Conclusion

Households and government in Iran are two major sources of funding for health expenditure, and contribution of each of them in the national health expenditure may change at the expense of the other. The budget of Iranian government is highly dependent on the revenues from the sale of its crude oil and natural gas to foreign economies. Hence, any unexpected exogenous change at lowering rate in the government revenues may affect national health accounts inappropriately. In Iran, this could be recognized by high value of households' marginal propensity to consume health services. That is, unexpected reduction in the government health expenditure, induced by the reduction in the government revenues, results in the decline of total health expenditure, and then, in the rise in the households' expenditure to compensate, partly, the initial fall of

the health expenditure. The first result could be recognized by the effect of the elasticity of households' consumption with respect to aggregate income spent on health services, or by the effect of high rate of households' propensity to consume health services on households' consumption of health services. The second result could be understood by the effect of the elasticity of households' consumption of health services with respect to households' liquid assets, and/or compensating rate of households' spending on health services, induced by the lessened share of government in the national health accounts.

In the Iranian health sector, lack of policies concerning changes in the funding shares of government and households in the aggregate health accounts, and changes in the households funding mechanisms in terms of health insurance prepayment and out-of-pocket payment could be considered sources of disturbing influences of decline in government budget and fall of households' ability to pay at recession or restriction times. This holds poor households at risks of health costs, and increases the probability of incidence of catastrophic health expenditures for households. To avoid this, government needs to stabilize its share in the total health expenditure by introducing new taxes or any other internal sources for health expenditure, and to facilitate health insurance mechanism for the households in low income deciles, aiming at increasing insurance prepayments sum in the total health expenditure. In the recent years, other health policies in Iran, concerning health services provision reform by increasing the access to health services in the public sector hospitals and clinics, and reducing households' out-of-pocket payments in the total health expenditure are welcomed, but in the absence of quantitative targeting and assessment modelling, it is not clear how the results will be assessed. The modelling feature and findings of this study could be regarded as the useful means of health policy assessment for one important portion of the total health expenditure that is concerned with households' consumption of health services.

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